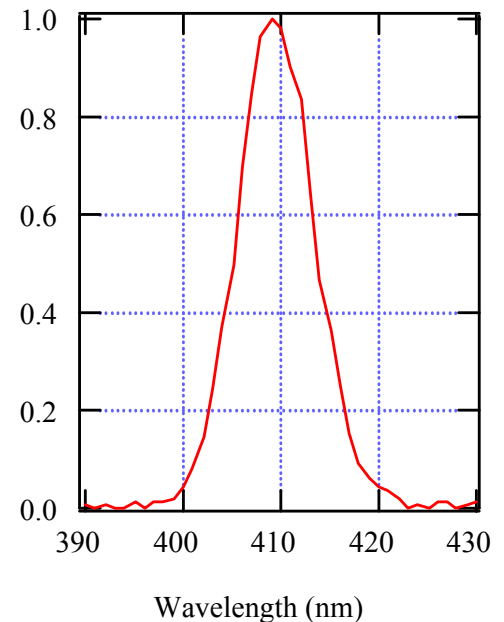


# Ultrafast studies of scattering dynamics in gold

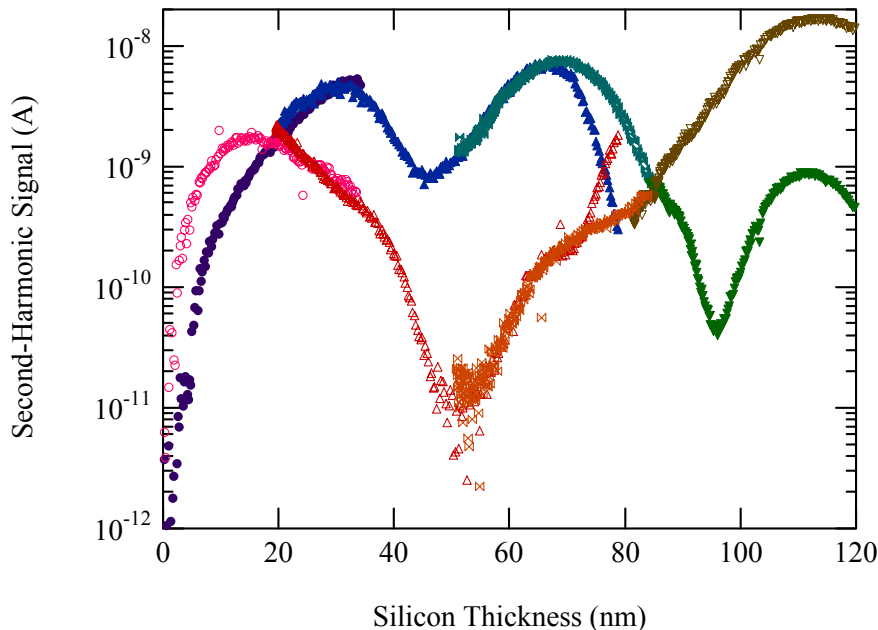
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The short pulse laser system acquired through the NSF MRI program is in its second year of use as a tool for doing original research and training undergraduates. This year, five undergraduates will do their senior thesis using the laser system.

At right is a spectrum of second-harmonic light that was generated by focusing a 50-fs laser pulse to  $\sim 10^{11}$  W/cm<sup>2</sup> at a gold surface. Through Fourier transformations, the spectrum provides information about what is happening at the gold surface in the time domain. From data like this, taken in the spectral domain, and time-resolved data taken directly in the time domain, we gain a deeper understanding of the scattering events which govern metals' behavior on ephemeral time scales.



# Surface or Bulk?



Second-harmonic light reflecting from a thin layer of silicon surrounded by silicon dioxide, as a function of the thickness of the silicon layer. Interference effects at both the laser wavelength and the second-harmonic wavelength modulate the observed signal. Open symbols correspond to perpendicular polarization of the incident light; filled symbols to parallel. We have developed a general theory for harmonic generation in multilayers and are now applying this theory to these data.

When light reflects from the surface of a solid, the reflection comes from a layer that extends thousands of atoms deep into the material. Normal reflection is a *bulk* effect. With the intense beam of our amplified titanium-sapphire laser, it is possible to produce a reflection at twice the frequency (the second harmonic), which is sensitive to the upper one or two atomic layers. This can provide a non-damaging probe of surfaces and interfaces, which is interesting for quality control in making integrated circuits.

However, second-harmonic light can also come from the bulk. Our work aims to determine the relative importance of surface and bulk contributions to the second-harmonic signal in thin silicon layers surrounded by oxide.